Living Labs for Sustainability at Keele: Progress and Challenges

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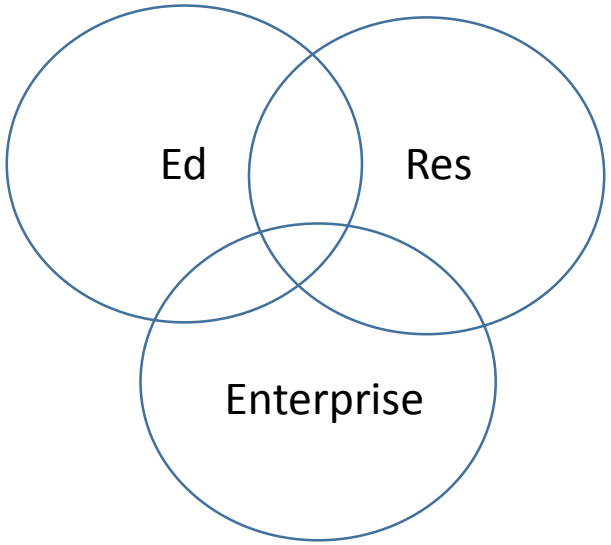
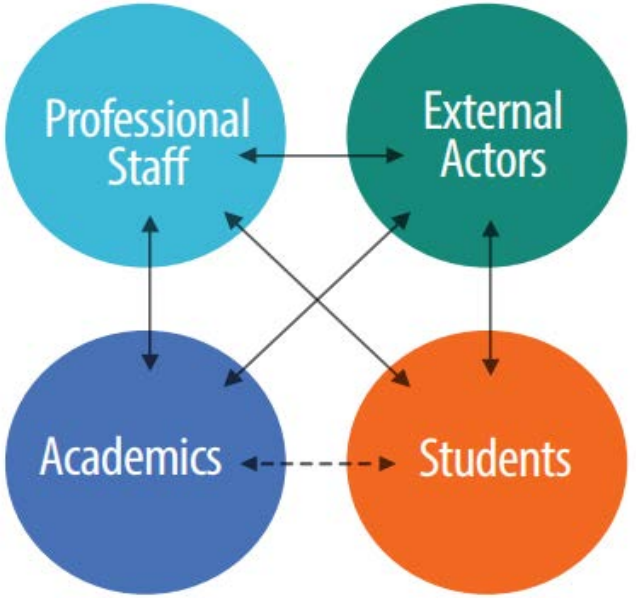
Outline

1. What's happening at Keele?
2. What have we learnt?
3. What are the major challenges to address in setting up a more formalised Living Lab?

How am I conceptualising Living Labs (for Sustainability)?

- Integration of different stakeholders and missions (which are often separate
- A tool to increase sustainability impact across different missions
- A tool to maximise potential across different missions
- A tool to bring the different missions together





Stakeholders

Living Labs for Sustainability at Keele

Strategic Aim 5: "To promote environmental sustainability in all that we do"

- Continue to improve the environmental sustainability of the University through **campus developments**, carbon reduction and the impact of University operations
- Have world-leading **research** in environmental sustainability
- **Educate our students** on environmental issues and provide opportunities for them to put strategies into practice
- Provide **leadership** in application and implementation of environmental sustainability
- Be sector-leading in environmental education and **engagement** with business, external organisations and communities

CASE STUDY

Creating a campus-scale laboratory for low carbon energy research

Dr Zoe Robinson and **Dr Ian Madley** describe the application of the Living Lab approach at Keele University, to research and develop smart energy strategies and technologies in partnership with the local community, and the importance of making 'invisible' sustainability projects 'visible', in order to maximize educational potential.

Keele University is at the start of a major development which will transform the campus into a 'Living Laboratory' (commonly known as a Living Lab) for experimentation with low carbon energy solutions. Keele University is a 615 acre mixed use campus university, incorporating staff and student housing, sports, catering and entertainment facilities, and academic and commercial uses (**Figure 1**). As a substantial campus university, Keele operates its own sizeable energy distribution network, giving it control over its own energy infrastructure as well as having total responsibility for its energy and carbon costs. Its size and mixed use makes it analogous to a small town, and an ideal laboratory for researching at-scale low carbon energy solutions, hence these developments will see the entire campus become a living and working environment that is controlled and managed to minimise carbon use – a genuine Living Lab.

SEND: Smart Energy Network Demonstrator

A test-bed to research, develop and test the environmental sustainability and technical feasibility of more flexible energy networks and new energy efficient and low-carbon technologies….(and management strategies and behavioural change)

https://www.youtube.com/watch?v=CkuAp2M91yY

E&T ENGINEERING AND TECHNOLOGY

Academics launch five-year plan for smart energy grid the size of a small town

By Josh Loeb

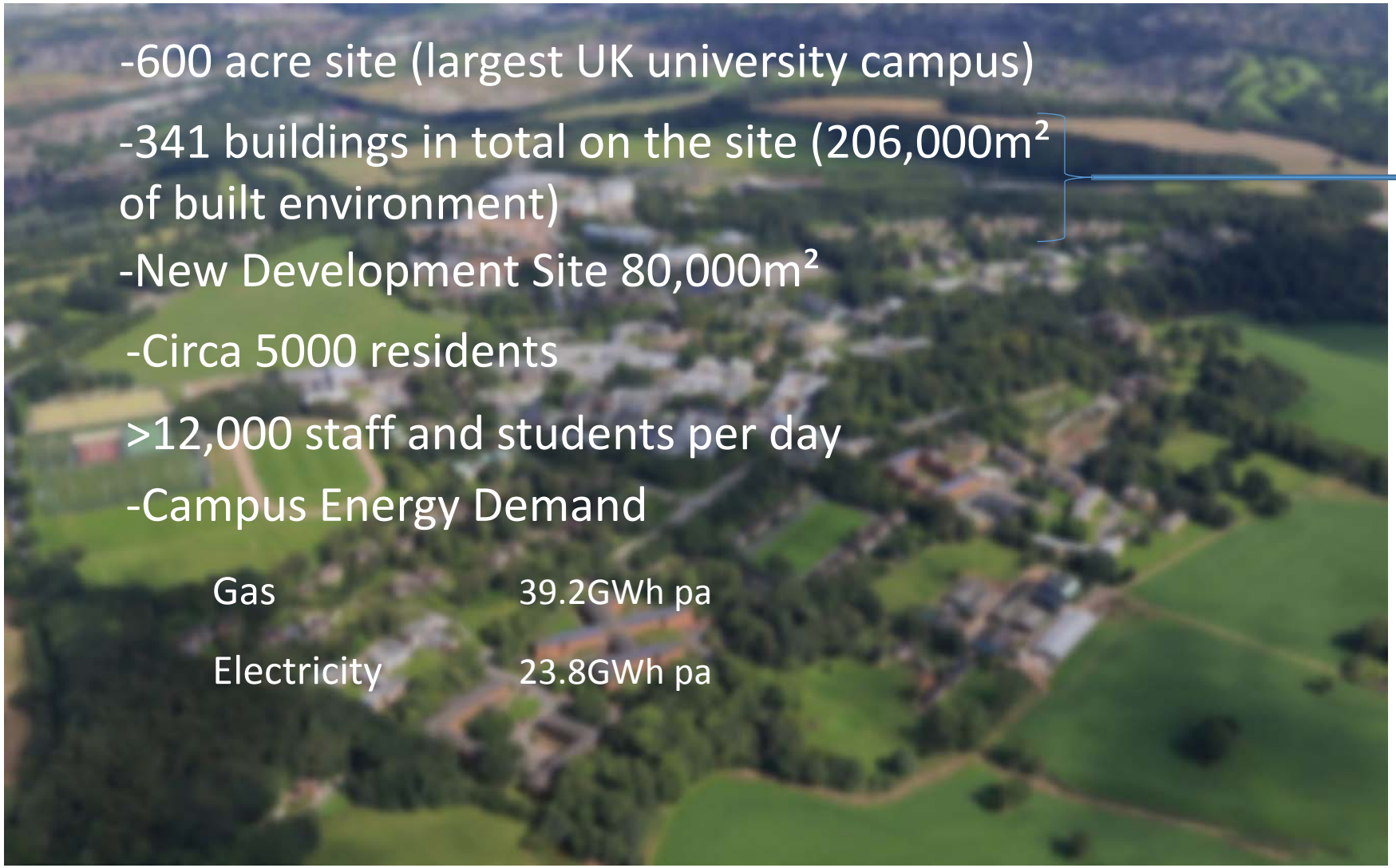
Published Wednesday, June 14, 2017

Keele University secures £15m in funding to turn its campus into a 'living laboratory' where the latest developments in renewable microgeneration and battery storage can be trialled, tested and refined

Keele UNIVERSITY

SIEMENS

Small Town Demand



-600 acre site (largest UK university campus)

-341 buildings in total on the site (206,000m² of built environment)

-New Development Site 80,000m²

-Circa 5000 residents

>12,000 staff and students per day

-Campus Energy Demand

Gas	39.2GWh pa
Electricity	23.8GWh pa

Buildings	Gross Internal Area m²	No of Buildings
Academic & Support	96,500	61
Residential (Student)	73,500	153
Residential (Staff)	20,000	121
Commercial	16,000	6
Totals	**206,000**	**341**

European Union
European Regional Development Fund
Funded by UK Government
Keele UNIVERSITY

A Small Town Infrastructure

>10km of underground gas network

6 primary metering points (MP/LP)

>18km of electrical network (cable)

22 sub-stations (11KV/LV)

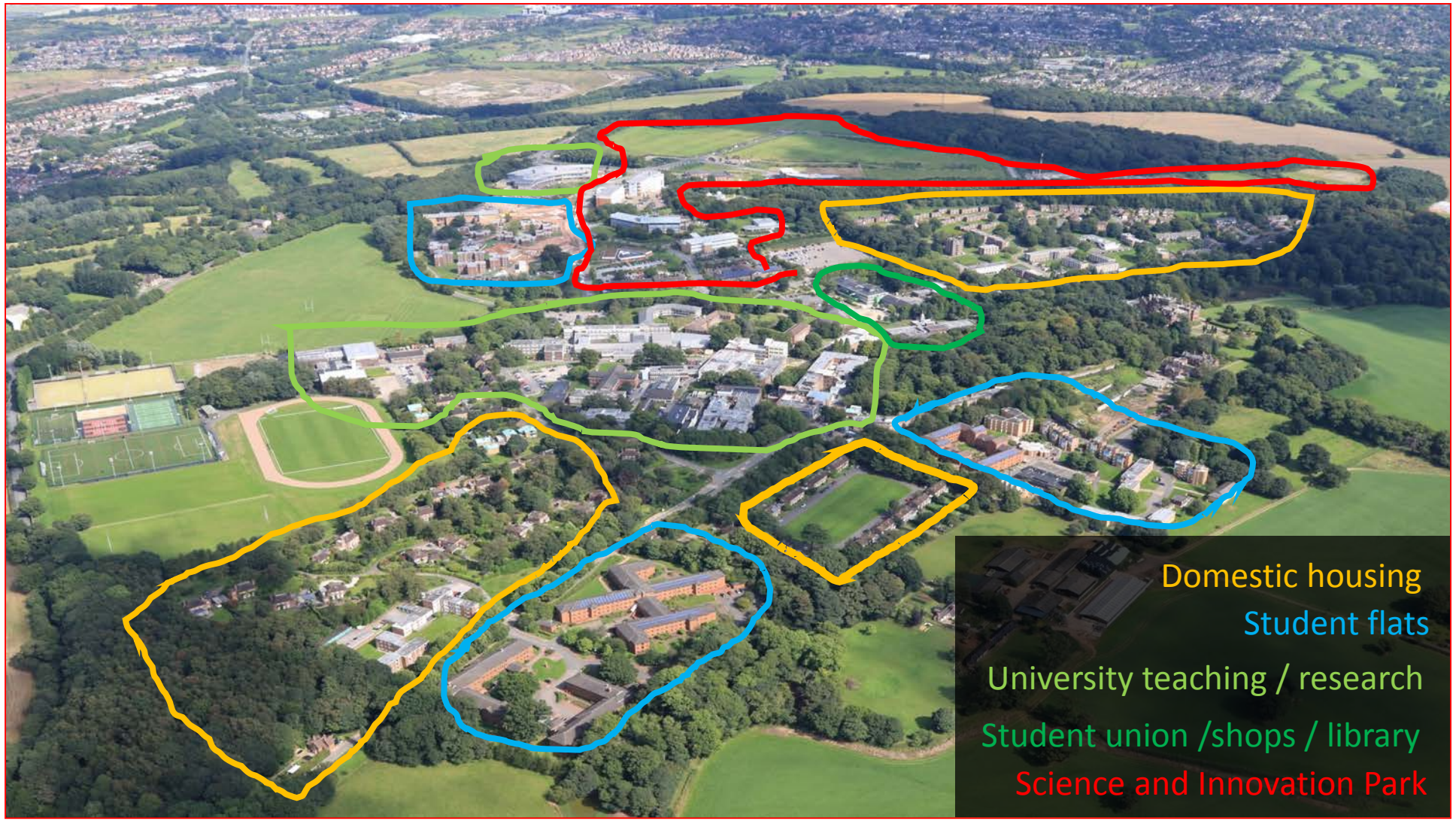
>28km of fibre-optic cabling

> 6km district heating

>16km of mains water network

>16km of surface and foul water drainage

A Small Town Living Laboratory



Key Outputs

- 4096 T CO_2e reduction pa by 2021 (circa 30% current emissions)
- Cost reduction through optimised network management
- Enable a high penetration of renewables
- Living Lab to enable R&D by academics and industry
- Generate £40m GVA uplift from the government's £16m investment (>2:1 ROI) increasing to £80m GVA by 2036 (>5:1 ROI).

Funded by

- Keele university
- Department for business, energy and industrial strategy
- European regional development fund (part of the england 2014 to 2020 european structural investment find (esif) growth programme)
- Linked to 20 phd studentships

Funder targets

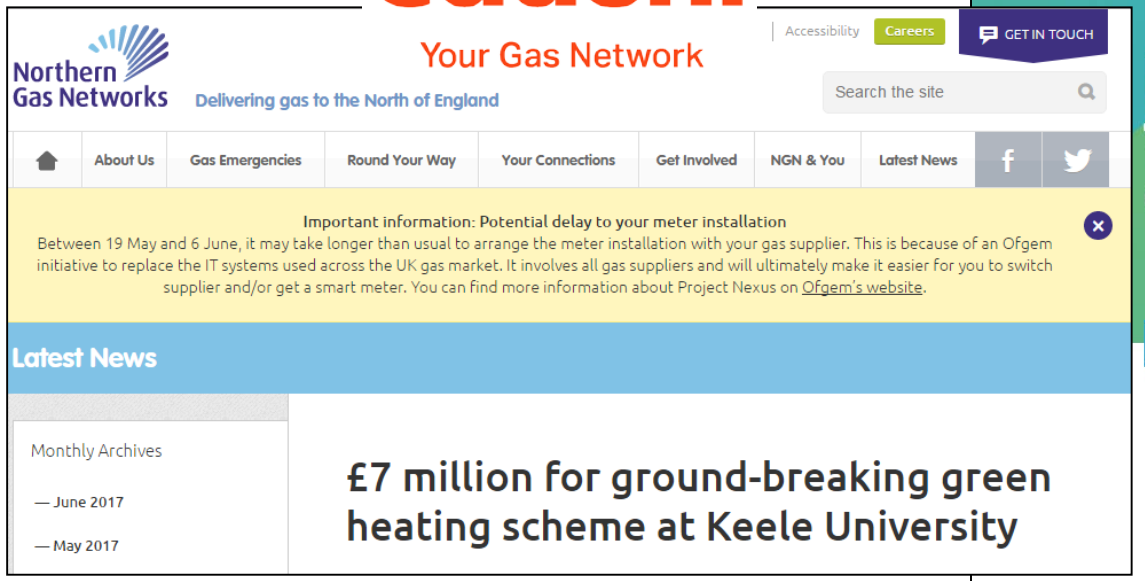
- 30% Carbon reduction per annum (4096 tco2e/a by end 2021).
- 243 Companies to receive support, 26 working with phd students
- 15-20 Companies first time engagement with a research-based institution
- 7 'New to the company' products
- 5 Business start ups

Next Steps

- Develop 5MW renewable generation / 10MW storage
  - Seeking investor / constructor / operator
  - Offer long-term supply contract certainty
  - Initial mix of wind / solar / battery storage
- Explore new approaches as part of SEND research
  - What are fundable projects
  - Using new technology to address fuel poverty
  - Exploring new energy resources e.g. mine water
- Integrating Education and Student Experience
  - Projects for Students
  - Hackathon challenges
  - Internship opportunities

HyDeploy @Keele

- Trialing 20% blended hydrogen in the gas supply
- Keele campus trial first phase of national project
- Domestic and commercial properties
- Significant regulatory challenges overcome



Smart Road Trial

- Co-creation of problem
- Solution ‘challenges’ to industry

THE WEEK AT KEELE

Keele UNIVERSITY

£1.9m funding to develop new road technologies

A new £1.9 million “Live Lab” project aims to extend the Smart Highways network to local roads, and will support the creation of a ‘living laboratory’ at Keele to develop, test and demonstrate how such a network can be designed and maintained, as part of a new government funding package announced this week.
Read more

amey

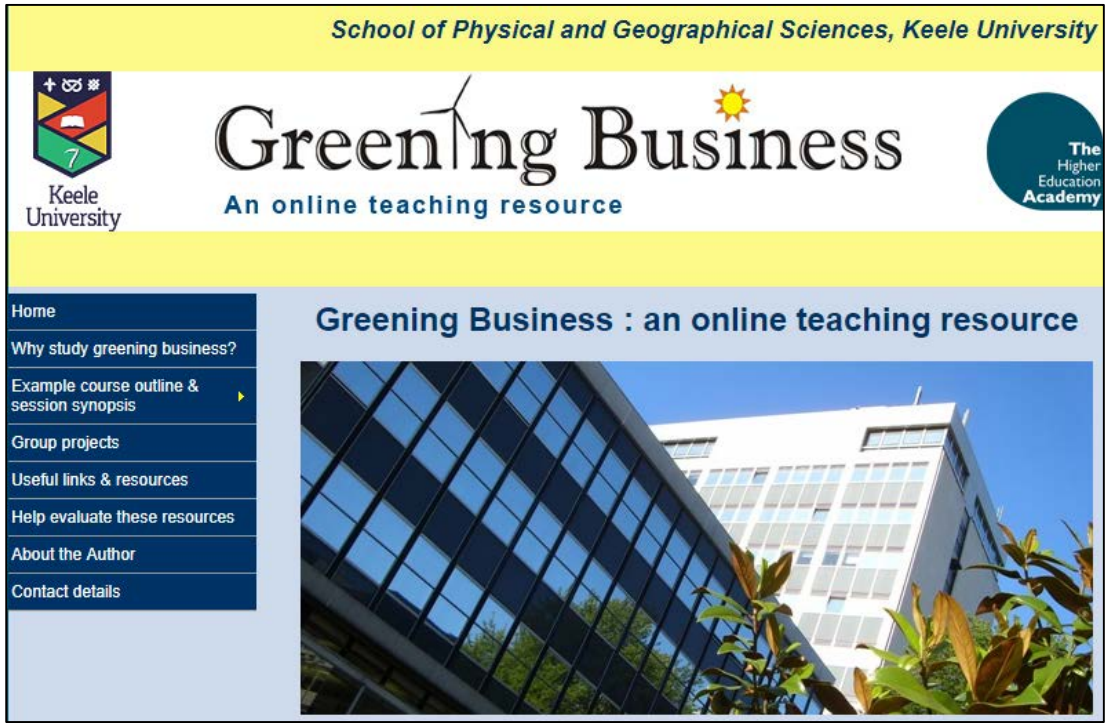
Staffordshire County Council

Learning

- Need for co-creation between different stakeholder groups from the start
- Preconceptions about different stakeholders ie ‘build it and they will come’ – it takes time to build understanding
- Structures for external collaboration are needed – gaps in in-house research expertise, need to ensure university benefit
- The role of the generalist – to see breadth of opportunities and connections
- A tendency to see education in a limited way, a lack of consideration of educational outcomes

A more traditional Living Lab model?: ‘Greening Business’

- 1st year module, run for 10 years
- Problem-based learning around improving sustainability of campus
- ‘Problems’ co-created with Environmental Manager, Sustainability Project Officer, Director of Education for Sustainability
- ‘Solutions’ communicated through 5 minute video presentation attended by internal sustainability stakeholders



Greening Business learning

- Time of the key stakeholders in providing data and background information
- Ethics barrier for short-timescale projects - students can’t collect social data
- Variable quality of projects

Key issues to work on

- Feeding back to stakeholders
- Feeding forward to future cohorts
- Data access

Formalising a Living Lab: Keele interest in Living Labs across University

- Business
- Research (Institute for Sustainable Futures)
- Education (Keele Institute for Innovation and Teaching Excellence)
- Estate

- Success criteria?
  - Educational outcomes
  - Research metrics/outcomes
  - Environmental/social/economic sustainability

Key Challenges to Address in a new Living Lab system

- **Data:** Accessibility, security, ethics, transparency, what data (and why)?
- **Co-creation:** Across different missions from the start
- **Breadth:** Across different subjects
- **Communication:**
  - Feedback and feed forward
  - Different subjects/missions
- **Scale:** are the changes big enough? Fast enough?

Lord Lindsay's (founder of Keele University) vision

A new *kind* of university

"If we are going to try and keep a democratic country and maintain understanding of one another, we have to send out people from our universities who can do the technical stuff and who at the same time have an understanding of political and social problems and of the values that lie behind them".

A commitment to meet the demands of a new kind of society, economy and world

Living Labs: Ensuring holistic solutions?

Data for data's sake?

Are university campuses turning into mini smart cities?

Universities are experimenting with AI and big data to improve how students live and learn on campus

▲ The University of Michigan introduced an on-campus self-driving shuttle system last year. Photograph: University of Michigan

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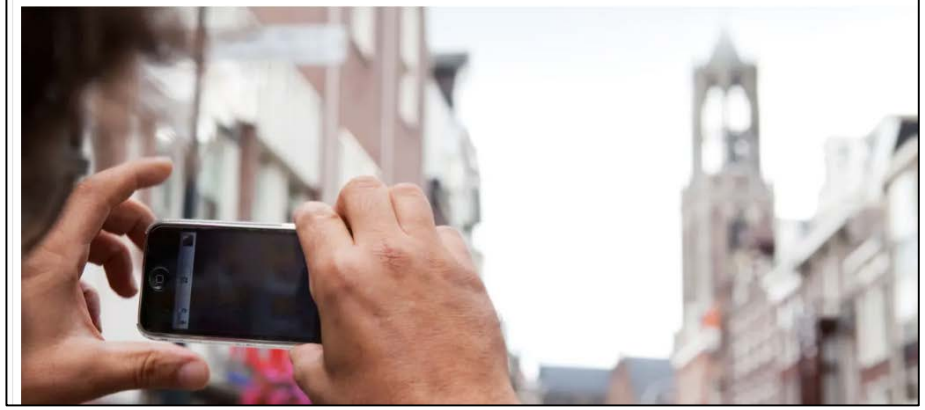
'Living laboratories': the Dutch cities amassing data on oblivious residents



Turning cities into living labs to improve our health and wellbeing

In a time of urban growth, cities must become places to experiment with creative ideas to improve our health and wellbeing

● Click here for a gallery of examples from around the world putting living labs principles into practice

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Keele UNIVERSITY